

REVIEW ARTICLE

Need of Nutrient Management for Sustainable Agriculture – A Review

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ABSTRACT

Sustainable agriculture is a mode of production in which we focus primarily on supporting farmers, resources and communities through the promotion of profitable, ecologically sound agricultural practices and methods that are good for communities. This form of agriculture allows us to produce healthy foods without compromising the needs of future generations. The population has increased to 6.9 billion in 2010, 2.5 billion in 1950 and 3.7 billion in 1970. To meet the growing needs for food, farmers focus on the intensive use of chemical fertilizers. Currently, developing countries account for almost 70% of global fertilizer consumption and this proportion could account for more than three quarters of global consumption by 2050. Annual consumption of N + P₂O₅ + K₂O has increased by around 66 thousand Tons in 1951-1952 to 24,482 million tons in 2013-14. In 2013, nitrogen accounted for 66% of total fertilizer consumption in India, while phosphorus and potassium were 26% and 8%, respectively. To solve the current problem, data was collected mainly from the Food and Agriculture Organization of the United Nations (FAO) and other agencies. The main objective of this research is to maintain the sustainability of agriculture through the adoption of appropriate strategies, such as the use of more effective fertilizers (urea covered with Neem), the selection of good cultural practices involving legume crops and increasing the use of organic inputs along with sensitizing farmers to soil tests through a system of soil health cards to avoid excessive use of fertilizers in order to maintain optimal production of food without damage the quality of the soil.

Key words: Sustainable agriculture, food production, nutrient deficiencies, nutrient management

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INTRODUCTION

Sustainable agriculture is the production of food, fiber or other plant or animal products using farming techniques that protect the environment, public health, human communities and animal welfare. Sustainable agriculture mainly emphasizes on meeting food needs without deteriorating the environment and conserving resources for future generations. The art of agriculture in India dates back to prehistoric times. The use of dung as manure appears to have been practiced since the Rigvedic Age. The value of green manure like sesamum appears to have been known in periods as far as back as 1000 B.C. The practice of application of phosphatic fertilizers like bones dates back to about 300 B.C. Beginning of the use of mineral fertilizers in India is lost in antiquity but it must have been use well before the turn of the century because the first single super phosphate plant to manufacture it indigenously was set up in 1906 at Ranipet (Tamil Nadu). The first documented governmental emphasis on the use of mineral fertilizers for cereal crops was in the early green revolution. Adoption of intensive farming led to decline in soil fertility due to continuous removal of native nutrients from the soil. Apart from it, in order to increase the productivity of crops farmers reside on heavy use of chemicals into their fields. That is the fact that at present various food grains produce in India contains different traces of chemicals in them.

INCREASING NUTRIENT DEMAND

Population increased to 6.9 billion in 2010, up from 2.5 billion in 1950 and 3.7 billion in 1970. The UN population projections from the medium variant of the 2008 release employed here- indicate that the world total could reach 9.15 billion in 2050. Overall demand for agricultural products is expected to grow at 1.1 percent per year from 2005/2007-2050. China and India alone account for almost two-thirds of the developing countries fertilizer consumption but this could decline to about half the consumption in 2050 as other regions will catch up [1]. Smil [11] concluded that N fertilizer has contributed an estimated 40

percent to the increases in per-capita food production in the past 50 years, although there are local and regional differences and varying efficiencies.

Table 1: Projected increase in nutrient consumption in 2050
Million tons of nutrient (N, P and K)

Area	1961-63	2005-07	2050
Sub Saharan Africa	0.2	1	6
Latin America	1.1	17	45
Near East/North Africa	0.5	8	12
South Asia	0.6	27	59
East Asia	1.9	62	79
Developing countries	4.3	114	201
Excl. China & India	2.9	42	94
Developed countries	30.0	51	62

Source: www.fao.org

SCENARIO OF INDIAN AGRICULTURE

Undoubtedly India is proud of its 'Green Revolution' since from that time Indian starts adoption of high yielding varieties, pesticides and fertilizers which ultimately resulted in increased food production. But with the time, excessive use of pesticides and fertilizers deteriorate the soil health. India is the second largest consumer of fertilisers in the world, after China. It accounted for 15.3% of the world's N consumption, 19 per cent of phosphatic (P) and 14.4 per cent of potassic % (K) nutrients in 2008 [2]. The annual consumption of $N+P_2O_5+K_2O$ increased from about 66 thousand MT in 1951- 52 to 24.482 million MT in 2013-14. In 2013, nitrogen contributed to 66% of total fertilizer consumption in India, while phosphorus and potassium share was 26 and 8%, respectively [9]. In general agriculture, the use of chemical fertilizers cannot be ruled out completely but balanced fertilization is expected to help diminish environmental concerns while sustaining a strong food producing capacity.

Table 2: Consumption of nutrients in Punjab and adjoining states during 2013-14 (kg per ha)

State	N	P	K	Total
Punjab	174.68	41.65	3.08	221.63
Rajasthan	35.05	10.62	0.19	45.37
Haryana	168	35.26	2.18	206.91
Himachal Pradesh	34.08	8.45	8.79	51.32

Source: fert.nic.in

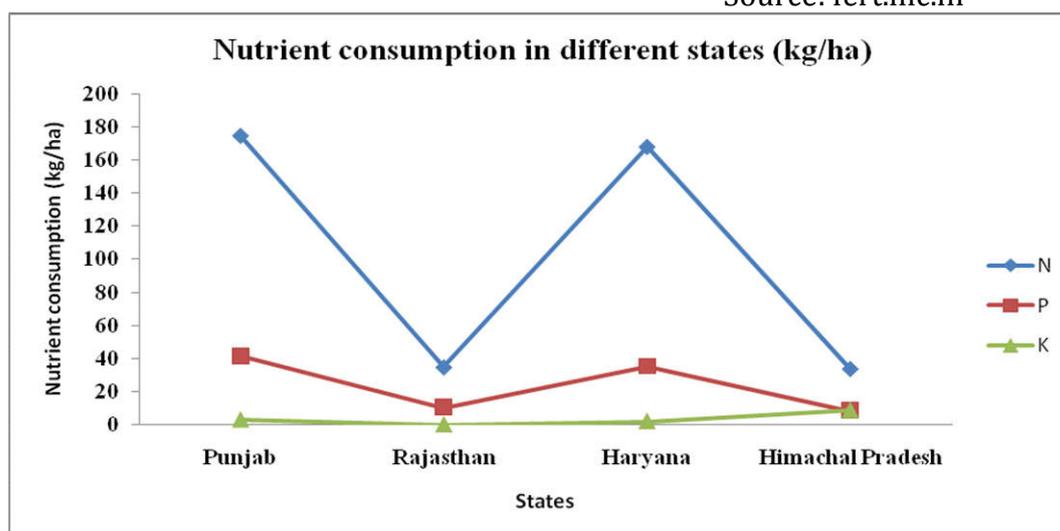


Fig1. Nutrient consumption in different states

PROBLEMS REGARDING EXCESS USE OF FERTILIZERS

The least available nutrient, generally nitrogen, offering the highest return, was applied preferentially. Applicability of nitrogen-containing fertilizer at or below than optimum levels help in proper build up of

organic nitrogen in the soil whereas excessive and imbalance use of synthetic nitrogen sources cause loss of native nitrogen that ultimately makes soil devoid of good structure as well as soil biomass [6]. Nitrogen applied through fertilizers of ammonical nature produce acidic conditions in the soil [7]. The return per hectare is important as short term return on the money invested in fertilizers.

Another problem related to overuse of fertilizers is that it cause various health problems to living beings. Health problems arise due to inhalation of pesticides and consumption of food material containing chemical residues.

STRATEGIES FOR BALANCED USE OF FERTILIZERS

Adoption of proper cropping pattern

A green manure is a type of cover crop grown and ploughed generally for organic matter which ultimately improves the soil. The average amounts of N accumulated by green manures can entirely substitute for mineral fertilizer N at current average application rates. It was often observed that legumes, in contrast to cereals, have a beneficial effect on grain yield of subsequent cereal crops [10]. Furthermore, growing green manure crops in rotation with cash crops also disrupts life cycle of diseases, insects, or weeds improving cash crop yields [4].

Use of organic inputs

The use of organic soil amendments has been associated with desirable soil properties. These have huge potential for maintaining nutrient supply which can reduce the dependence of farmers on chemical fertilizers use. Organic manures has been used for centuries as a fertilizer for farming. Organic manures help in improving soil structure and soil biomass [5]. It also improves the chemical properties of the soil by increasing soil organic carbon, nitrogen, phosphorus and potassium content in the soil [3].

Use of fertilizers having high use efficiency

Fertilizers with enhanced efficiency are classified as under-

- a) **Slow released fertilizers-** Urea super granules and Urea formaldehyde
- b) **Controlled-release fertilizers-** Coated or encapsulated fertilizers
- c) **Stabilized fertilizer-** Stabilized with the treatment of nitrification inhibitors
- d) **Nano-Fertilizers-** They are of nano sized (1 nm – 100 nm)

DEVELOPMENT OF SUITABLE VARIETIES

Genetically engineered crops possessed great advantage in agriculture, Bt cotton is one of them. Bt cotton contains a bacterial protein that kills pests, such as the cotton bollworm, without harming beneficial insects. In India, farmers by growing Bt cotton increased the overall yield by 24% and their profits by 50% over traditional varieties cultivation [8]. A more recent technology called genome editing, which makes it possible to precisely alter DNA sequences in living cells is expected to lead to new crop varieties in the near future [12].

CONCLUSION

In the future, Indian agriculture will be dominated by fertilizers to meet the growing food needs. To prevent nutrient imbalance, it is necessary to adopt techniques that use the fertilizer until they are effective, and the use of fertilizers should be carried out as indicated. It takes a total effort to use all the available organic resources locally and to recycle the nutrients properly. The use of organic fertilizers should be promoted through incentives and appropriate strategies, the latter being promising and potentially available for agriculture. In the same way, the appropriate rotation of appropriate crops and varieties can be adopted taking into account all aspects.

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